DOCUMENT RESUME

ED 201 501 SE 034 841

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TITLE Multidisciplinary Education 31E: Environmental Studies. Study Guide.
INSTITUTION Indiana Univ., Bloomington. School of Continuing Studies.
PUB DATE 80
NOTE 82p.; Appendix, pages 43-57, removed due to copyright restrictions. Contains photographs which may not reproduce well.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS College Programs; *Ecology; *Environmental Education; *Higher Education; *Independent Study; Interdisciplinary Approach; *Science Education; Science Instruction; Secondary Education; Social Problems; *Social Studies

ABSTRACT

Presented is the learner's guide for a high school level independent study course in environmental studies. The manual is divided into two sections: (1) The Nature of the Environment, with lessons on ecosystems, limiting factors, interdependence and adaptation; and (2) Economic, Political, Behavioral, and Ethical Aspects of Environmental Studies, which covers population, energy, the urban environment and ethics. Each of the nine lessons lists objectives, presents a reading assignment, discusses the readings, offers a self test, and provides a written assignment. This correspondence course is offered by Indiana University's Independent Study Division. (WB)

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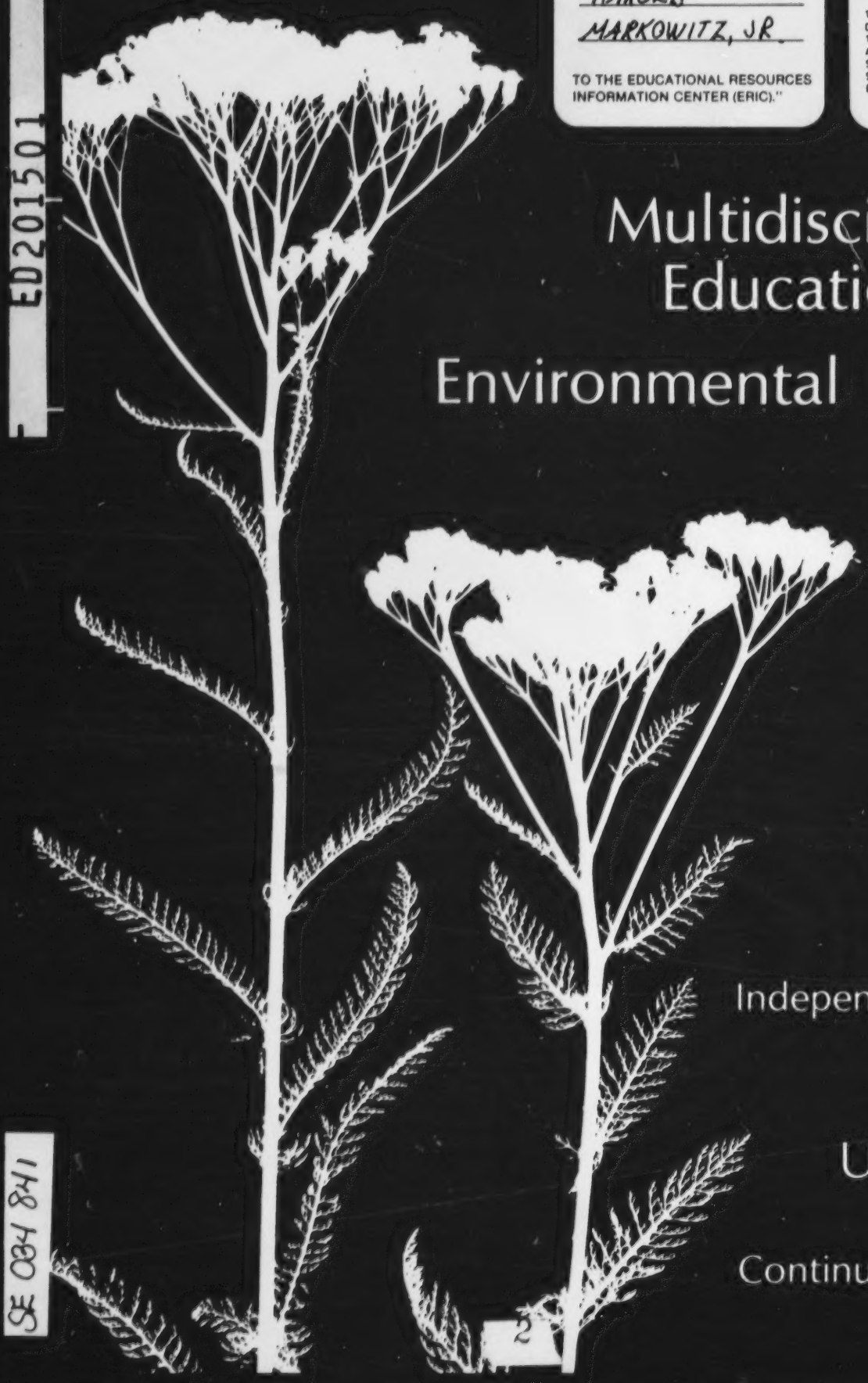
Multidisciplinary Education 31E: Environmental Studies



Independent Study Division

Indiana University

School of Continuing Studies

SE 034 841

–IMPORTANT–

Read before beginning your course

REGISTRATION NUMBER

A REGISTRATION NUMBER is assigned for each course in which you enroll. It consists of one letter and four digits, and appears on the title page of the study guide. This number must be used on all assignments and in all your correspondence. Use your registration number on the assignment cover sheet of each assignment. If the number is missing or incorrect, the processing of your lessons will be delayed.

If you are enrolled in more than one course, it is important to remember which registration number is assigned to each course. BE SURE TO USE THE CORRECT REGISTRATION NUMBER FOR EACH COURSE IN WHICH YOU ARE ENROLLED.

ASSIGNMENT COVER SHEET

In the back of your study guide is a supply of forms entitled ASSIGNMENT COVER SHEET. Use one of these forms as the front page of each assignment you submit. This form is necessary to return the graded lesson to you and to record your lesson grade. Unless an assignment cover sheet accompanies each assignment, prompt return of lessons and accurate recording of grades cannot be guaranteed.

LESSON DROP BOX

Students on the Bloomington campus may use the LESSON DROP BOX to submit their written assignments. This drop box is located outside Owen Hall, Room 001. Lessons deposited there are picked up daily and processed immediately. No postage is required on lessons deposited in the lesson drop box.

A STUDY GUIDE FOR

MULTIDISCIPLINARY EDUCATION 31E

ENVIRONMENTAL STUDIES

(One Half Unit)

Date of Registration_____

Registration Number_____

Instructor_____

Course designed by

Donald R. Winslow, M.S. in Ed.
Assistant Professor of Education
Indiana University, Bloomington

Edited by
Hazel Blumberg, M.A., M.S.

Indiana University School of Continuing Studies
Independent Study Division

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First printing: July, 1980

INDIANA UNIVERSITY

School of Continuing Studies

INDEPENDENT STUDY DIVISION
Owen Hall 001
Bloomington, Indiana 47405
812-337-3693

Dear Student:

Welcome to Independent Study. I am sure that you will find your correspondence study an enjoyable and worthwhile experience.

You will find that independent study places a great deal of responsibility on students for their own pacing. The key to success is to plan your study time carefully. Begin by completing and submitting your first lesson within a week of receiving your materials. Self-pacing is very important, particularly if your course completion must meet some deadline. A planned approach will ensure that you will cover the necessary material without rushing and will increase your overall enjoyment of the course and your knowledge of the subject matter.

Many former students have indicated that independent study has aided them in growing personally as well as helping them reach their academic goals. Your instructor will assist you in completing the course successfully; our instructors are noted for being extremely encouraging and responsive to their students' individual needs.

If you have a concern that you feel needs immediate attention you should write to your instructor, or if you are in Indiana you may use our toll-free telephone line, 1-800-822-4762. Administrative questions may be handled by calling 1-800-822-4792; out-of-state students call 1-800-457-4434.

Sincerely,

Dr. Harold Markowitz, Jr.
High School Program Coordinator
Independent Study Division

HM:nsh

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A NOTE FROM THE AUTHOR OF YOUR STUDY GUIDE

My introduction to Indiana was back in the fall of 1946 when I enrolled in Indiana University as a freshman and majored in zoology with minors in both chemistry and physics. I taught high school sciences in Martinsville, but since that time my professional career has centered around Indiana University in Bloomington.

In 1958 I became chairperson of the science department of the Division of University Schools and taught biology and advanced biology. I remained in that position until the University Schools severed their connection with the University and became associated with the Monroe County Community Schools. I remained with the University and began to teach science education classes in the School of Education.

One of my main interests is high school students and what they are doing in science. For several years I have chaired the Youth Activities Committee of the Indiana Academy of Science, which has the responsibility of supervising all of the Indiana Science Fairs, the Indiana Science Talent Search and the Junior Academy of Science. Consequently, many of my weekends throughout the year are devoted to high school and junior high school students.

My wife is a registered nurse and a former school nurse. Our son majored in photojournalism and is the main photographer for an Indiana daily newspaper.

We have many interests, but we spend as much time as we can in our backyard, one of two in Bloomington which is registered with the National Wildlife Backyard Program. This means that we have to provide several kinds of plants that give wildlife (primarily birds) both shelter and food. Most of the yard is landscaped with plants that we either propagated vegetatively or that we brought from Maine, my original home. The rest of the time I usually can be found with a camera around my neck attempting to shoot pictures of wildlife, or wishing we were back around the Atlantic shooting pictures of the coast.

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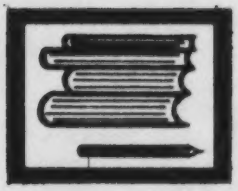


SUPPLIES:

A list of required textbooks for this course follows the introduction to the study guide. Texts should be ordered immediately to ensure that you have the correct editions. All required books are available through the Independent Study Division. Use the order form following the book list, indicating the publication date and specific edition required for the course. Book prices change frequently; all prices shown are for new books. Used books will be substituted, if available and if requested. Order books in one of three ways:

1. If you live in the United States (except Alaska and Hawaii), you may order books C.O.D. The address cannot be a post office box number.

2. You may use Master Charge to pay for books by including the necessary information on the order form.

3. You may pay by check or money order (payable to Indiana University), sent with the order form. Overpayments of more than $1 will be refunded.

When you have completed the course you may sell back the books for half the new price, provided they are still used by Independent Study. Package them securely and enclose the form in the back of this study guide or a note with your name, address, and registration number. You may telephone tollfree to check on whether the books are still used. In Indiana call 800-822-4792; outside of Indiana dial 800-457-4434.

PREPARATION OF ASSIGNMENTS:

As soon as you have the required books, begin the course. Read the study guide introduction which follows; it includes any special instructions about the course. Proceed through the lessons in the order in which they are presented; most courses require you to read portions of the texts as well as a discussion in each lesson before beginning the written assignment.

Use standard-size typing or notebook paper for assignments. Either type your work, double-spaced, or write legibly in dark ink on lined paper. Use one side only of the paper and leave ample margins.

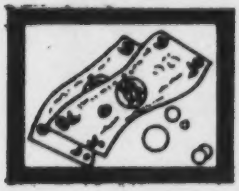
Attach an assignment cover sheet from the back of the study guide to each written assignment. Complete the top and bottom portions of the cover sheet and mail it in one of the lessons envelopes provided. Be sure to include your registration number. Unless the introduction states otherwise, you may begin work on your next lesson before the first one has been returned. If you wish to submit more than one lesson at a time, enclose a note with your first lesson, requesting your instructor's permission to do so.

TIME ALLOWANCE AND EXTENSIONS:

You are allowed one calendar year from the date of registration to complete the course. If you cannot complete it in that time, an extension of six months will be granted for a fee of $10. You may have two such six-month extensions.

GRADES:

Your instructor will read, correct, and comment upon each written assignment. The introduction includes grading criteria. When your instructor issues a final course grade, a report will be sent to you. University credit is recorded in the Indiana University Office of Records and Admissions on a permanent transcript; a grade report will be sent also to the college you have designated if other than I.U., Bloomington. High school credit is reported to the high school you have designated.

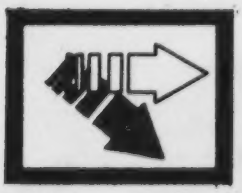


REFUND POLICY FOR WITHDRAWAL:

High school and continuing education: The course fee will be refunded, less $10 and $1.90 per submitted lesson, if you withdraw within two months of your enrollment date.

University: The course fee will be refunded, less $10 and $2 per submitted lesson, if you withdraw within one month of your enrollment date. If you withdraw between one and two months of your enrollment date, one half the course fee will be refunded, less $2 per submitted lesson.

You must formally notify the Independent Study Division of your intention to withdraw.



FURTHER INFORMATION:

You may call the Division tollfree. If you have administrative questions about your course or want information about other independent study programs and opportunities, call 800-822-4792 (Indiana) or 800-457-4434 (rest of the U.S.). Indiana students who wish to talk with their instructor may call 800-822-4762. These phone lines are available Monday through Friday, 8 a.m. until 9 p.m.

Written inquiries may be sent to the Independent Study Division, Owen Hall, Indiana University, Bloomington, Indiana 47405.

You may also request a copy of the Division's annual bulletin; use the request form in the back of this study guide.

INTRODUCTION

Introduction: Environmental Studies

Course Overview

The environment of the human is no longer solely the land, sea, and air. The concept of environment is larger than the biological concept of earth, the physical concept of planet, or the cultural concept of world. People now need a "larger mind" to encompass this new concept of environment. The cultivation of this larger mind is the function of education.

When viewed in this broader context, study about the environment takes on new dimensions and complexities. We must be concerned with the interdependence of people and surroundings and must be responsible for sustaining a healthy environment. The study of the environment is an integral part of the domain of citizenship. Because we as citizens are not necessarily specialists, a proper study of humans in their environment cannot be limited just to the study of science, ecology, the social studies, economics, engineering, or a variety of technologies. Every person is responsible for our environment.

You and I must include in our lives a concern with the health of the environment. In being able to analyze some decisions that have been made to alter these surroundings of ours, a more appropriate synthesis may be developed. By examining the acts of scientists, economists, architects, city planners, or outdoor educators, we as informed citizens can help maintain the beauty and health of the communities in which we live and help to keep their environments in ecological balance. We must maintain an environment fit for life.

Course Overview (cont.)

We are constantly bombarded with problems posed by pesticides, pollution, population, and pressures placed on our natural resources. Some of us have difficulty recognizing these as problems. We may ask ourselves, "Why do most of the citizens of the world recognize these as problems only when they become critical?" Our thought processes are generally directed by objects and events. If the object or event is not recognized, a problem concerning the environment may not be clear to everyone at the same time. Indeed, an object or event is recognized only when the concept to which it has relevance is understood. Otherwise, the problem may not be clarified. We must strengthen our knowledge and problem-solving skills so that we can recognize these environmental problems before they become extremely critical. We must also establish a set of standards or values by means of which we can make decisions about the desirability, fitness, or quality of an object, behavior, or event.

Values are standards of what a person feels to be desirable. Values are of extreme importance in making a decision. Values become involved when there are two or more choices, each choice calling for a different course of action.

Judgments are often made without all the facts, especially when all the facts are not available. Even before a conceptual framework may be clear, a decision may have to be made. Concepts and values merge whenever a decision is being made. One of the major objectives of this course is to give you an opportunity to be discriminating about data, to generalize these data into facts, to expand facts into concepts, and to test values. Your home, your classroom, your community, or even the state, the nation, and the world may become your "laboratory." When and where teaching and learning occur must not be bounded by the school's walls.

There are five key concepts in this course. These correspond to five of the 28 premises developed by a panel of experts and 95 students who were asked what they thought might be done to improve their schools for the next century. In *Curriculum Change Toward the 21st Century* Harold Shane reports on the desirability of creating and strengthening the following abilities:

Course Overview (cont.)

1. developing an in-depth knowledge of the world and its peoples; developing a knowledge of *realities*

2. developing awareness of *alternative solutions* to problems, a requisite in a world in which compromise and persuasion must replace force

3. developing sensitivity to the *consequences* of one's choices

4. cultivating the insights and values that support wise *choices* among alternatives

5. possessing the skills, information, and motivation that are requisites for *implementation*.[1]

This course is divided into two major parts. The first part (Lessons 1 through 5) deals with the nature of the environment. For all practical purposes the total amount of matter on our planet is fixed. The earth is a closed system with no matter entering or leaving. The chemicals necessary for life must be cycled and recycled continuously throughout the ecosphere. This requires energy, energy which is supplied constantly by the sun, some of which is lost in each transfer.

In Part I of the course, we will acquire some knowledge of the following topics:

1. structure of the ecosystem
2. ecosystem functions: energy and nutrient cycles
3. diversity and stability
4. interdependence
5. limiting factors
6. succession and adaptation

An environmental crisis cannot be understood in purely "scientific" terms. In Part II of this course (Lessons 6 through 9) we will consider the economic, political, behavioral, and ethical aspects of environmental studies. What is the nature of the problems we face?

[1]Harold G. Shane. *Curriculum Change Toward the 21st Century*. Washington, D.C.: National Education Association, 1977, pages 69-70.

Course Overview (cont.)

What is our individual responsibility toward others and toward preserving our life-support system? We will begin to look more deeply into these complex questions so that we may, in turn, convert our understanding into effective individual and group action. We will gain experience by practicing problem-solving skills. We will examine the possibilities of developing an environmental ethic.

Written Assignments

There will be variety in the written assignments. You will find some thought questions based on specific reading assignments. These will demand analysis and synthesis. Some of the assignments will require the collecting and analysis of data. Others will be based on optional field experiences. Many of the assignments will have no one right answer. These will help you to gain experience in problem-solving, choosing alternatives, and making trade-offs based on judgment and values. Environmental education involves communication, caring about others, and coping with everyday problems. A written assignment will accompany each study guide lesson.

Examinations

I have included several "self-tests" in the study guide. These are designed to help you evaluate your own progress and are not to be mailed to your instructor.

You will have one proctored examination, which will be your final examination. The final examination will contain essay questions. Further information about the examination can be found in Lesson 10.

Grading Procedure

Your final grade will be broken down as follows: The written assignments will count as 80 percent of this grade, and the final examination will be worth 20 percent of the grade. Grades for homework assignments and the final examination will range from an "A+" (worth 12 points) to an "F" (worth 0 points). An "I" (Incomplete) will be given on homework assignments *only*. The assignment must be completed and re-submitted in order for you to receive a grade. Pluses and minuses will be assigned.

Contacting Your Instructor

If you have any questions about or difficulty with the course, please do not hesitate to contact your instructor. Indiana residents may call toll-free between 8 a.m. and 9 p.m. workdays by dialing 1-800-822-4762. Others may call 1-812-337-3693. Send letters to your instructor in care of the Independent Study Division, or use the designated portion of the assignment cover sheet.

STUDY MATERIALS for MULTIDISCIPLINARY EDUCATION 31E
ENVIRONMENTAL STUDIES

Greisel, Irma and Peter Jensch. *Investigating Our Ecosystem.* Boston: Houghton Mifflin Company, 1976.

Approximate price: $ 5.00
Indiana sales tax: .20

McCombs, Lawrence W. and Nicholas Rosa. *What's Ecology?* Menlo Park, California: Addison-Wesley Publishing Company, 1978.

Approximate price: $ 6.00
Indiana sales tax: .24

(Indiana sales tax is not charged in cases where texts are mailed to an out-of-state address.)

Textbooks for independent study may be ordered most readily through the Independent Study Division, Owen Hall, Indiana University, Bloomington, Indiana 47405, using the order form on the opposite page of this guide. You may enclose a check payable to Indiana University for the appropriate total amount. If within the United States (except Alaska and Hawaii), you may request that the books be sent C.O.D.

Independent Study Division
Indiana University
Owen Hall
Bloomington, Indiana 47405

ORDER FORM FOR SUPPLIES

Student's name--please print _____ Registration number _____

Address _____ Today's date _____

City, state, and zip code _____

Course number and title Multidisciplinary Education 31E: Environmental Studies

Texts and supplies desired (author, title, publisher, edition)	Approximate price
Subtotal	
Indiana residents only: add 4% state sales tax	
Handling and transportation	2.00
Total	

Check one: ___Master Charge®. Provide the necessary information below.
___C.O.D. (Within the U.S., except Alaska and Hawaii.)
___Prepaid order. Make check or money order payable to Indiana University.

___ Send used books, if available.

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Card I.D. Number above name on card

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Name on card—please print

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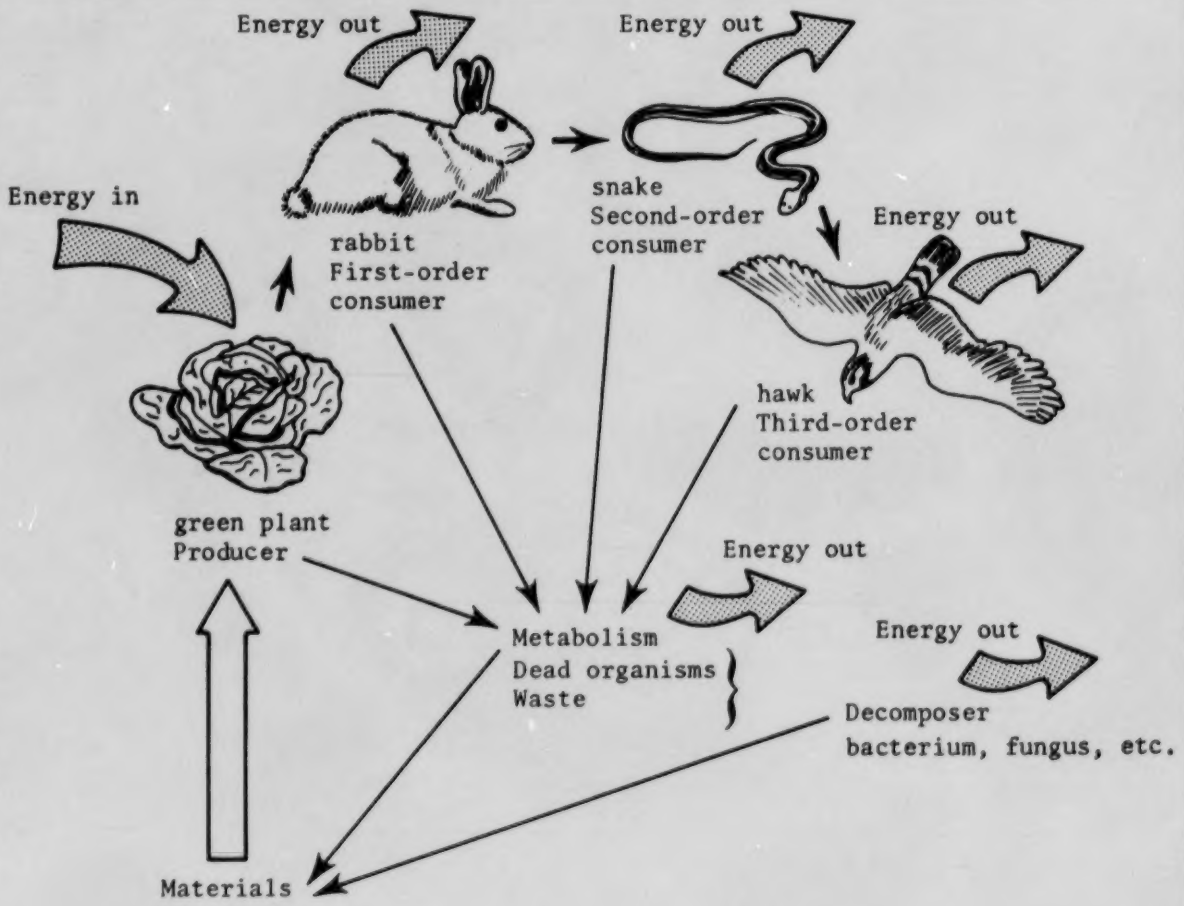
PART I

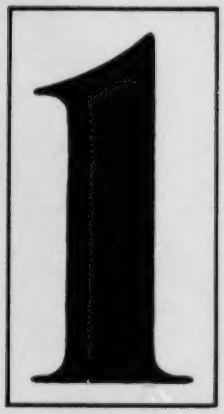
THE NATURE OF THE ENVIRONMENT



The simplest possible ecosystem consists of only producers and decomposers; these are the critical elements of any ecosystem.

Energy is constantly lost as it is transferred through an ecosystem; however, it is replaced by sunlight. Matter is present in a fixed amount; it must be recycled. Decomposers, with the assistance of scavengers, release the materials of dead organisms and waste materials so that they can be recycled.

Living Things; Structure of the Ecosystem



Objectives

After completing Lesson 1 you will be able to

1. define the following terms: decomposer, ecosystem, closed ecosystem, habitat, open ecosystem, producer, scavenger, niche, primary consumer, secondary consumer, and pollution

2. identify and give examples of the above terms

3. state a minimum of two possible interrelationships in your local environment between each of the items in the following groups:

   a. deer, trees, coyotes, humans
   b. decaying log, forest floor, insects
   c. grass, cattle, milk, human
   d. gardener, lawn grass, dandelions

Reading Assignment

McCombs and Rosa, *What's Ecology?*, pages 1-30.

Greisel and Jensch, *Investigating Our Ecosystem*, pages 1-10.

Discussion

The *environment*--defined as that outer physical biological system in which man and other organisms live--is a whole, albeit a complicated one with many interacting components. The wise management of that environment depends upon an understanding of

Discussion
(cont.)

> those components: of its rocks, minerals, soils and waters, of its lands and their present and potential vegetation, of its animal life and potential for livestock husbandry, and of its climate. It demands positive and realistic planning that balances human needs against the potential the environment has for meeting them.[1]

In any discussion of the environment, *ecosystem* is a frequently used term. It refers to a system of interrelationships between all of the organisms and their chemical and physical environment. Ecosystem literally means the relationships among all of the things on the planet earth.

There is no doubt that people's present methods of interaction with their *ecosphere* (the total ecosystem) cannot be continued indefinitely without suicidal consequences. The earth's environment is deteriorating rapidly. We are beginning to realize that the question, "How long can the earth support life?" is unanswerable at the present. Our problems include maximizing the efficiency with which we consume raw materials and minimizing the problems of waste disposal. To date, the efficiency of our consumption has been extremely low. This may have resulted to some degree from lack of concern and a belief that there is no limit to our natural and man-made resources. In the mid-1960s we in the United States comprised only about 6 percent of the world's population, yet we used over 60 percent of the mineral resources currently mined from the earth.

The rising concern with environmental issues has been attributed mainly to an increasing realization of the limited carrying capacity of the environment and to the fact that people have created an increasing number of environmental problems in attempting to achieve better living conditions. Such problems could have been avoided through appropriate development planning and environmental management.

[1]United Nations Environment Programme. *The state of the environment: 1979.* Nairobi, Kenya: United Nations Environment Programme, 1979, page 1.

Lesson 1
Multidisciplinary Education 31E

Self-Test

What's Ecology?: On page 13, answer the Test Yourself items 9 and 10. On page 30, answer the Test Yourself items 6 and 8.

Try to answer these from memory. If you have difficulty, look up the answers in your textbooks. This test is for your benefit and is *not* to be sent to your instructor.

Written Assignment

This assignment is to be submitted to your instructor.

Investigating Our Ecosystem: On pages 7-10, read the Prelab of the Our Ecosystem Series 1. Then complete one of the Labs and its accompanying Postlab. From the three separate labs provided, choose the one most suitable for your selected study area.

Note:

Please be sure to include an assignment cover sheet with this written assignment and with all subsequent assignments. The cover sheet should be labeled "Written Assignment 1." Include your student registration number on all assignment cover sheets and on all correspondence with the Independent Study Division. Also, please enclose the Student Information Form (on the following page) with your first written assignment.

INDIANA UNIVERSITY
SCHOOL OF CONTINUING STUDIES
INDEPENDENT STUDY DIVISION

Please complete the following information and submit this form to your instructor with your first written assignment.

Name_____ Age_____

Address_____

What is your purpose in taking this course?_____

_____

_____

If you must meet a deadline in completing this course, what is it?_____

_____

Please list any courses you have taken in the past, or those you are currently taking, which relate to this course. Show dates of completion._____

_____

_____

Are you currently enrolled in school? ___ Yes ___ No

If yes, what is your grade level?_____

Additional comments that will help your instructor understand your individual needs or possible problems:_____

_____

_____

_____

_____

_____

Ecosystem Functions

Objectives

After completing Lesson 2 you will be able to

1. depict on a graph or chart the increase in world population during the last 10,000 years and locate the agricultural, industrial, and transportation revolutions on the graph
2. identify a minimum of four characteristics of the life style of the human before the agricultural revolution
3. depict a minimum of four changes in life style which occurred during each of the three revolutions
4. diagram a simple food chain with which you are familiar in your everyday life
5. describe why it is more important to discuss the importance of food webs rather than just simple food chains

Reading Assignment

What's Ecology?, pages 31-43.

Investigating Our Ecosystem, pages 11-20.

Discussion

No population lives alone. Every group of organisms interacts with other populations. In a complex web of relationships, each population interacts with both its biotic and its abiotic environment.

Discussion (cont.)

An ecosystem may be large or small, simple or complex. To understand an ecosystem as a whole is a little complicated and difficult to do all at once. Generally ecologists start by studying a *biotic community* (a set of interacting organisms). Although ecologists may choose to concentrate their investigation on a community, they cannot understand it fully unless all of the factors of its abiotic environment are considered, too.

The changes that people make in ecosystems usually result in the reduction of the number of organisms. For example, in the Midwest, forests and prairies, which contained a great many kinds of plants, have been changed into cultivated fields in which one kind of plant (like corn or soybeans) is raised.

In observing all kinds of relationships, ecologists have concluded that there is a *web of life*; all organisms affect each other directly or indirectly. There are two parts to consider in this web: *energy* and *matter*.

Look around a classroom. Observe other students. As still as they may be, you can observe activity. Even a living plant in the room is active; it grows. Activity requires energy. Whenever anything in the room happens, it requires some kind of energy. You should ask, "What is the source of this energy?"

If the plant you may have observed is green, it is an organism that is capable of carrying on photosynthesis. Photosynthesizing organisms are called *producers*, because they produce the energy-containing substances on which all other organisms depend. All non-photosynthesizing organisms like ourselves are called *consumers*. For example, a plant like grass takes light energy and changes it to chemical energy. A cow eats the grass, and then we, in turn, eat part of the cow. The energy is passed along from a producer to a consumer and then to another consumer. This is an example of an *energy pathway*.

Directly or indirectly, organisms get their energy from the sun. They get their matter (those chemical substances known as elements and compounds) from the earth. Energy has to be supplied continuously from outside the

Discussion (cont.)

earth. It flows on a one-way street through the living world and as it flows through the ecosystem some energy is lost in each transfer. In contrast, all of the matter in living things is "earth matter"; the supply is limited to the quantity of matter present in the earth. It must be used over and over again. The elements that occur in living things circulate, that is, they move from nonliving things into living things, back to nonliving, and so on. This process is repeated over and over. Such circulation is known as a *cycle*. Look at the carbon-oxygen cycle on page 50, and the nitrogen cycle on page 46 of *What's Ecology?* Air cycles are shown in Figure 6-1, page 87 of *Investigating Our Ecosystem*.

Each organism, regardless of its mode of nutrition, grows at the expense of specific substances taken from the environment. Consequently, the life of a species cannot continue if any substance essential to its growth becomes exhausted. The cycles referred to in your textbooks describe the specific series of chemical changes by which each of these elements is utilized and finally restored in its original form to the environment.

Self-Test

What's Ecology?: On pages 42-43, concentrate on Test Yourself items 7 and 10.

Try to answer these from memory. If you have difficulty, look up the answers in your textbooks. This test is for your benefit and is *not* to be sent to your instructor.

Written Assignment

This assignment is to be submitted to your instructor.

Our Ecosystem: On page 20, read the Prelab of the Human Ecosystem Series 1, and write out the Lab and the Postlab.

Limiting Factors

3

Objectives

After completing Lesson 3 you will be able to

1. give some specific examples of limiting factors in your own environment
2. demonstrate that if an organism is to survive, each of the necessary elements must be present in the proper amounts
3. gain an understanding of factors which affect the growth of populations
4. explain how limiting factors may work together

Reading Assignment

What's Ecology?, pages 44-55.

Discussion

Each kind of organism occupies a specific kind of environment. Some organisms are very narrow in their preferences; others, with a high degree of tolerance for many extreme physical factors, probably are widespread throughout the world. An organism is limited by its own physical needs.

Water, light, temperature, and the availability of oxygen are some of the physical components of an environment that may serve as *limiting factors*. Another very important factor in determining the range of some organisms is the availability of minerals and nutrient substances in the soil.

Discussion (cont.)

As we discussed in the previous chapter, in addition to non-living factors, each organism may be affected by other living organisms. A certain bird may be limited by the range of a particular plant it needs for food or for a nesting spot. Some plants may depend upon a certain kind of insect for pollination. Although interested in individual organisms, an ecologist likely will group them into *populations* (groups of organisms of the same kind).

In the last chapter you became familiar with cycles. The main parts of the nitrogen cycle are shown in Figure 4-1, page 46 of *What's Ecology?* This is a very simple diagramatic representation of the cycle but a very important one. Nitrogen is essential to the making of proteins, which are the building blocks of tissues. It is important that we understand that, even though nitrogen is one of the most abundant chemicals on the earth, making up about 78 percent of the atmosphere, organisms cannot use pure nitrogen gas in building their tissues. We, as consumers, are dependent upon the activities of many kinds of organisms for our proteins.

Space is another limiting factor that must receive some consideration. Crowding and congestion cause problems in many kinds of populations. Space is an important factor for plants and protists. Many of them live attached to a *substrate* (a substance upon which another organism lives). Because most of them can move, animals are not affected as greatly as plants. Space is closely related to *population density*, which is the number of individuals in a given area, or amount of space.

Unless there is a disaster, the sizes of plant and animal populations in nature remain fairly constant generation after generation. Is this also true of humans?

So far we have been considering mostly chemical limits for an ecosystem. There are other considerations, too. For example, in the case of a human population, values and culture may serve as limiting factors. Almost anything affecting the lives of organisms may limit a population.

Discussion (cont.)

Have you ever visited a greenhouse? How many different microclimates or ecosystems existed in the greenhouse? Even over distances of a few meters conditions may change enough to produce slightly different habitats. In an area such as this, such factors as temperature, light, water, and nutrients can be controlled well enough to "trick" plants into blooming, growing tall or dwarfed. A horticulturist may control many other characteristics, as well.

Self-Test

What's Ecology?: On page 55, work out the answers to Test Yourself items 2, 4, 6, 8, 9, 10, 11, and 12.

Try to answer these from memory. If you have difficulty, look up the answers in your textbook. This test is for your benefit and is *not* to be sent to your instructor.

Written Assignment

This assignment is to be submitted to your instructor.

Answer the following questions.

1. How may parasitism be a limiting factor of an organism?
2. What is *carrying capacity*?
3. What is *predation?* Are humans predators? Why or why not?
4. Only a specific number of cows should graze in a given area. What limiting factors should be considered?
5. What is meant by the environment of an organism? Explain this in your own words.
6. How are the terms *food* and *nutrient* related?
7. If all life on earth ceased, what changes in the cycles of substances might you reasonably expect?

Written Assignment (cont.)

8. In making a journey into outer space, one must take along a part of the human environment. Try to design an "efficient" package of the biosphere for such a journey.

Interdependence

Objectives

After completing Lesson 4 you will be able to:

1. list several reasons why the ecosystem should be examined in its entirety
2. describe your own life zones in terms of its climate, soil, dominant producers, primary and secondary consumers
3. give an example of a succession and of a climax association with which you are familiar
4. sketch and explain a food pyramid found in your study area
5. list several ways in which organisms control their population

Reading Assignment

Investigating Our Ecosystem, pages 134-147.

Discussion

Through 3.5 billion years the earth has evolved into a complex and delicately balanced ecosystem. Yet humans have risen above this natural balance and exploited and adapted to their advantage large areas of this living world. In spite of these manipulations, one of your texts suggests that the ecosystem should be examined and explored as a whole organism, not in the same manner as a physician might examine a being, a heart, or some

Discussion (cont.)

other organ, but for a change "a look at the whole body" at once. No longer can living things be viewed as a random collection of individual species. Many investigators are beginning to realize that all life acts collectively.

You have already discovered that the ecosystem requires a great deal of energy for all of its activities, and that the ultimate source of this energy is the sun. If the ecosystem is to survive, energy must be added constantly. Without this continual supply, structure and function break down. Because only *autotrophs* (producers) can trap and change this light energy to chemical energy, all other organisms depend on them. The result is a series of *feeding levels* through which potential energy and materials are transferred. These producers make up the first feeding level (trophic).

A consumer which feeds directly on one of these producers is called a *first-order (primary) consumer*. These are also called *herbivores*, or plant eaters. Herbivores make up the second feeding level (trophic). While herbivores are called first-order (primary) consumers, they represent the second feeding level in the energy transfer. Consumers that feed on other consumers are called *carnivores*, or meat eaters. Second-order (secondary) and third-order (tertiary) consumers are carnivores. In addition, some animals, like man, are *omnivores*, both plant and animal eaters.

Each time one living thing feeds on another, there is a transfer of materials and potential energy. This transfer from organism to organism forms a series called a *food chain*. A food chain represents only one possible transfer route; many other routes exist. All possible feeding relationships in an ecosystem make up a *food web*.

corn →	mouse →	snake →	owl
producer	first-order (primary) consumer	second-order (secondary) consumer	third-order (tertiary) consumer

Discussion (cont.)

Energy is lost along a food chain. The amount of energy actually transferred at each level depends on the ecosystem. What happens to this lost energy? Some of it is lost as heat; some of it is used for life functions such as growth and development. Much of the potential energy at each level is never transferred to the next level. What implications does this have for humans who might exist on top of a food chain? Ecologists refer to the transfer of energy as a *pyramid of energy*. Can you describe why as you examine the diagram on the following page?

Self-Test

Investigating Our Ecosystem: On page 147, answer the Situation Review items 1 through 10.

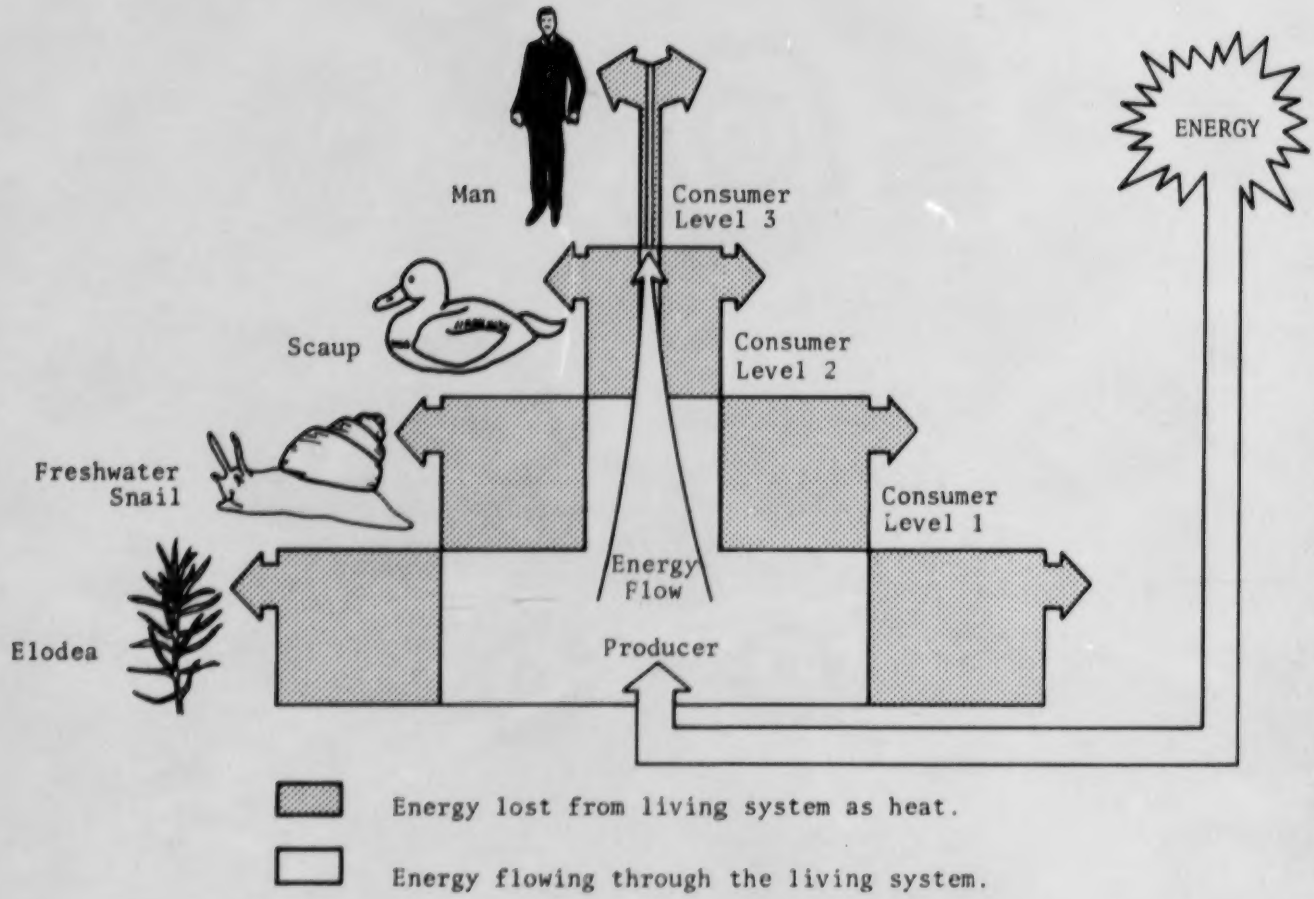
Try to answer these from memory. If you have difficulty, look up the answers in your text. This review is for your benefit and is *not* to be sent to your instructor. Concentrate on the kind of community found in your area or one with which you are most familiar.

Written Assignment

This assignment is to be submitted to your instructor.

Investigating Our Ecosystem: On pages 135-136, read the Prelab. Then complete the Lab and Postlab. Note that this is an extended exercise in that the Lab requires a minimum time of one month.

Pyramid of Energy food chain levels



Succession and Adaptation

Objectives

After completing Lesson 5 you will be able to

1. describe what is meant by succession in an ecosystem
2. explain the concept of a human climax community
3. understand the role of the major factors which contribute to the stability of the population of any particular species of plant or animal in a life zone

Reading Assignment

What's Ecology?, pages 79-94.

Investigating Our Ecosystem, pages 134-147.

Discussion

Today in the United States it is almost impossible to find an ecosystem that has not been altered in the last century by human actions. Even in our state and national park systems, as well as our wilderness areas, campers, hunters, loggers, and fire fighters have changed the balance of climax communities. Road building, airport construction, farming, and other human activities have left few ecosystems in their natural states.

What does happen to an ecosystem when it has been destroyed or disturbed? When great changes take place by some agent like a fire or flood, observed shifts

Discussion (cont.)

take place very swiftly. These rapid alterations give clues about changes that go on rather slowly unnoticed from year to year in undisturbed ecosystems. This gradual replacing of one community of animals and plants with one another is called a *succession*. Succession even occurs in lakes, ponds, and streams; it is not an activity just reserved for land forms. Even bare rock eventually can be turned into productive soil through the processes of erosion and succession. As you learned from your reading assignments, the general pattern of succession is very similar in most instances.

Succession is *directional*. This means that each stage of succession is more mature than a previous one. Each stage must also have an energy source and a way for recycling materials.

Succession that begins with bare rock is called *primary succession*. It is ecological succession in an area that has not been occupied previously by any plant community. For example, this first stage might involve hardy plants, such as lichens, which produce acids that may decompose the rock. Freezing and thawing of water, in turn, cause the rock to crack and break into smaller particles. Decomposers, such as bacteria, work on dead lichens and break them into simpler organic compounds. This process represents the beginning of soil formation. Plants such as mosses, and still later, grasses will eventually appear. Each stage of succession prepares the area for more complex stages. As you familiarize yourself with the plants and animals in your area you can carry this example through additional stages to a *climax community*. A climax community might be found in New England where beech and maples are the dominant species of plants in the forest, or in the southeastern United States where you might find an oak-hickory forest.

Climax communities are also found in Indiana. Some beech-maple climax is found in near-virgin forest in moderately moist areas (mesophytic sites); other examples can be found in Versailles State Park. On the higher, drier, sloping hillsides, especially in southern Indiana, the climax tends toward oak-hickory.

SUCCESSIONAL STAGES

The time duration for each stage varies due to such factors as variable climate conditions.

Corn	→	Annual Weeds	→	Perennial Weeds	→	Perennial Weeds	→	Perennial Weeds	→	Sub-Climax	→	Climax
field crop				blackberries dewberries briars		briars shrubs seedling maple and sweet gum trees				red maple sweet gum		beech-maple

Discussion (cont.)

Although the immediate discussion has been devoted mainly to primary succession, most succession is really secondary. Such succession results from the harvesting of forests, fires, agricultural cropping, and other disturbances or depletion of existing plants.

Although interference by humans has been common since the time of agriculture, over a long period of time climate has to be considered in community change, too. What kinds of animals are associated with the climax community you have developed?

What happens to organisms and ecosystems through time may depend largely upon the kinds of changes a particular environment undergoes and upon the adaptability of the organisms associated with the environment. Many structures of organisms seem to be fitted to the ecological *niches* (the role of the organism) that the plants or animals occupy. A structure that adapts an organism to one environment might be a hindrance in another environment. On the whole, adaptations promote survival and reproduction of organisms. A complex adaptation evolves over a long period of time.

So far this discussion has included primarily those kinds of adaptations known as *morphological adaptations*. These adaptations involve the structures of organisms (anatomy). Examples are hooves of horses and the hand of humans. How is each of these structures adapted for its function? *Physiological* and *behavioral adaptations* must be considered, too. The secretion of a poisonous venom is a physiological adaptation of many snakes. The migration of birds, the storage of nuts by squirrels, and the positive response to the environment of some plants bending toward the light are examples of behavioral adaptations. These three types of adaptations are interrelated.

Self-Test

What's Ecology?: On pages 93-94, answer the Test Yourself items 1, 2, 3, and 5.

Try to answer these from memory. If you have difficulty, look up the answers in your text. This review is for your benefit and is *not* to be sent to your instructor.

Lesson 5
Multidisciplinary Education 31E

Written Assignment

This assignment is to be submitted to your instructor.

What's Ecology?: On pages 93-94, write out the answers to items 4, 6, 7, 8, and 9.

PART II

ECONOMIC, POLITICAL, BEHAVIORAL, AND ETHICAL ASPECTS OF ENVIRONMENTAL STUDIES

Population Problems

Objectives

After completing Lesson 6 you will be able to

1. list many of the changes in the human life styles which occurred during each of the three revolutions: agricultural, industrial, and transportation

2. explain some of the complicated relationships that exist among the various aspects of population growth, natural resources, land use, and food production

Reading Assignment

What's Ecology?, pages 56-78 and 178-196.

Investigating Our Ecosystem, pages 11-20.

Discussion

The term *population* already has been used many times throughout this study guide and in your textbooks. You probably have a pretty good idea what it means, but we need to examine it more closely for it really is one of the basic units studied by the ecologist. The terms *population explosion* and *population density* need to become just as familiar.

Item 9 on page 196 of *What's Ecology?* states:

> One ecologist recently stated that the population problem is the most important one facing humans today. If we solve this problem, we will have a chance at solving all the others. If we don't solve the population problem, none of the others will matter.

Discussion (cont.)

This may be fine if we divorce the human from all of the other organisms in the universe. But we must look at the total ecosystem, even if we wish to be concerned only with the human population. Humans are only a part of the total biotic community. There are no simple answers to this very controversial topic.

Many persons want to separate the human from all of the other organisms because of their religious backgrounds. They base their reasons on the following:

> [26]And God said, "Let us make a man--someone like ourselves, to be the master of all life upon the earth and in the skies and in the seas."
> [27]So God made man like his Maker.
> Like God did God make man;
> Man and maid did he make them.
> [28]And God blessed them and told them,
> "Multiply and fill the earth and subdue it;
> you are masters of the fish and birds and all the animals."[1]

What these persons should realize is that as the population grows, our resources vanish. The time now needed to add a billion humans to the earth's population has become incredibly short. It took two million years for the number of humans to reach one billion. The second billion required only one hundred years. Successive billions arrived even faster. At the present rate of increase in the world, the sixth billion will require only a decade. Lester Brown states that "if the present growth rate were to be maintained until this time next century, only a year would be needed to add one billion and a mere four years to add the present world population."[2]

[1]*The Living Bible* (paraphrased), Genesis: 26-29. Wheaton, Illinois: Tyndale House Publishers, 1971, page 1.

[2]Lester R. Brown. *The Twenty Ninth Day*. New York: W.W. Norton, 1978, page 73.

Discussion (cont.)

Let's state it another way. Every hour another 8,000 persons are being added to the earth's population. This is not just births alone, but births minus deaths. Each two days presents a population increase nearly the size of a city like Indianapolis.

From the information that is available to us, we need to take into account what has happened to past populations. We need to recognize some of the basic principles of ecology to explain changes in populations and to attempt to consider the possibilities for the future. You will have to make a decision about the course of action that seems best for you.

Self-Test

What's Ecology?: On pages 77-78, answer the Test Yourself items 1, 3, 6, and 8. On pages 195-196, answer the Test Yourself items 1, 2, 5, and 6.

Try to answer these from memory. If you have difficulty, look up the answers in your text. This review is for your benefit and is *not* to be sent to your instructor.

Written Assignment

This assignment is to be submitted to your instructor.

What's Ecology?: On pages 77-78, answer Items 4, 5, and 9. On pages 195-196, answer Items 3, 4, 7, and 8.

Investigating Our Ecosystem: On page 20, review the labs you did for Lesson 2.

Energy

Objectives

After completing Lesson 7 you will be able to

1. list a minimum of three ways that radiation can harm organisms
2. list a minimum of three ways in which radiation can be useful
3. discuss some of the advantages and disadvantages of other sources of energy compared with nuclear energy
4. discuss several of the problems created by the use of nuclear energy

Reading Assignment

What's Ecology?, pages 223-226.

Investigating Our Ecosystem, pages 120-133.

Anthony J. Parisi, "Exxon's Profits Rose 55 Percent Last Year to Record $4 Billion," study guide Appendix, page 43.

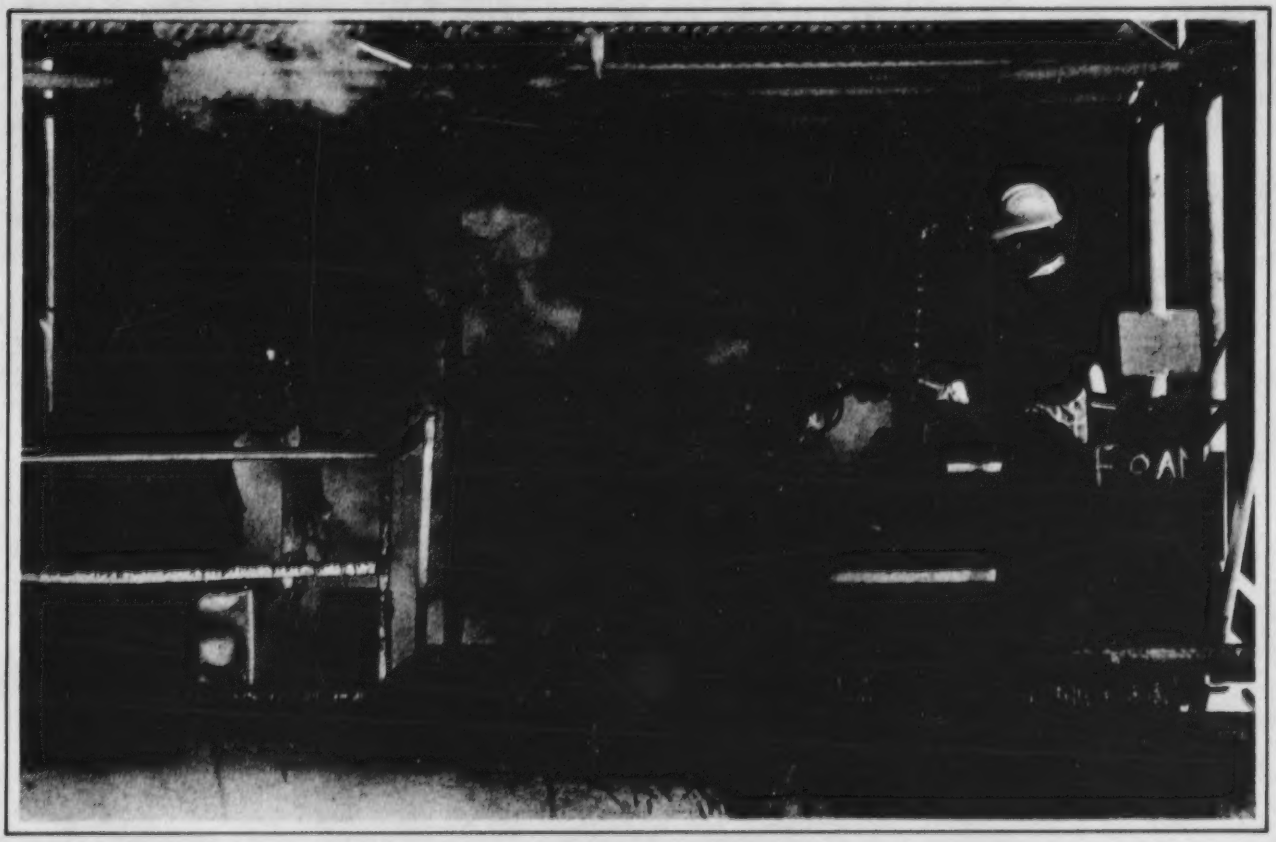
John Burr, "Dawn of New Energy Source," study guide Appendix, pages 44-45.

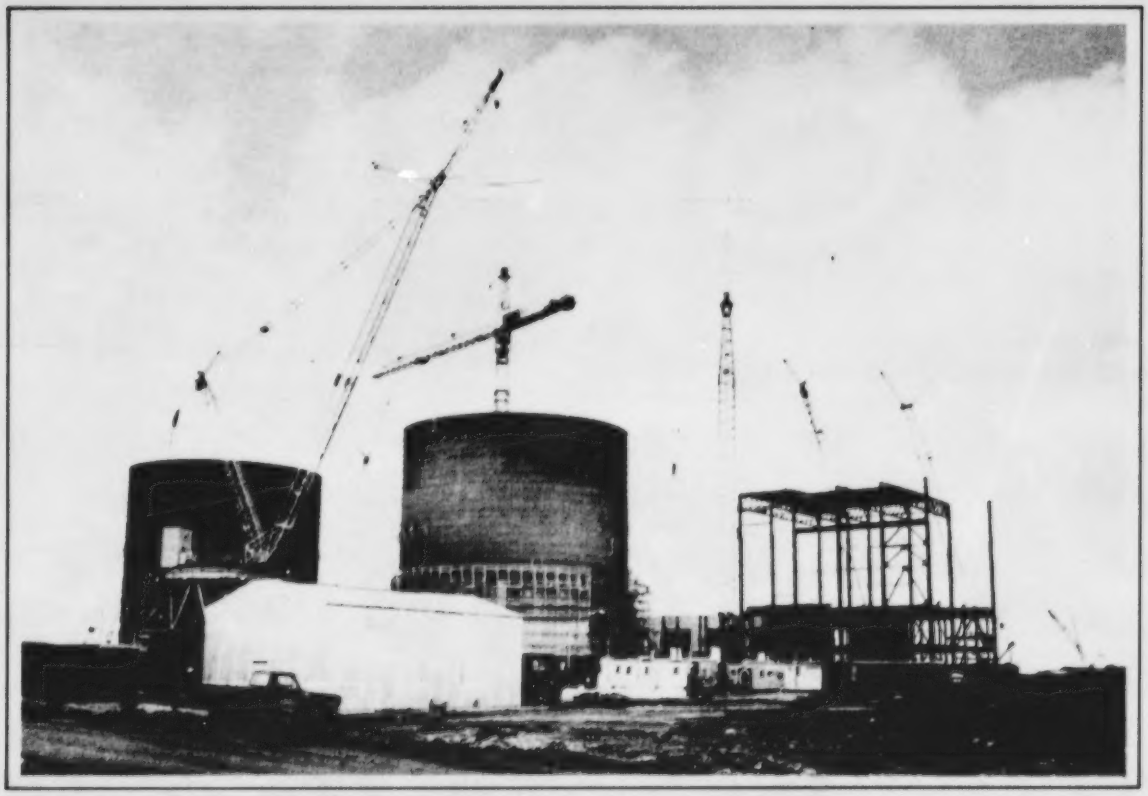
Upper left. A pumped-dry oil well.

Lower left. Laketon Refinery, Wabash County, Indiana.

Upper right. Suspended construction on the controversial Marble Hill nuclear power plant being built by Public Service Indiana on the Ohio River near Madison.

Lower right. Fighting a house fire which was caused by an improperly installed wood-burning stove.





Discussion

Much of the American public believes that energy problems are not real. Many persons tend to think that fuel companies and public utilities are creating false shortages in order to get higher prices. However, the most reliable information available indicates that world fuel shortages are indeed real.

Oil is still the principal fuel that powers the global economy, but the world of the foreseeable future promises to be one where petroleum is scarce and costly. The economic situation will contrast sharply with the time when oil was cheap and the supply was plentiful. In North America, the United States' production of oil peaked in 1970. Our country is highly dependent upon foreign imports. During the period from 1973 to 1978, the Organization of Petroleum Exporting Countries (OPEC) quadrupled the price of oil. The current Iranian revolution is affecting oil production and exporting of oil from that country. Until this time, it was the world's second ranking exporter. This sharp increase in prices is certain to influence world petroleum consumption. However, a decline in the oil supply does not necessarily translate into a decline in energy provided other energy sources are being brought into use as the oil wells are pumped dry.

Ever since the transportation revolution the human demand and use of energy has been doubling about every twenty years. (Some investigators indicate every ten years in the case of oil.) Our high-grade coal and natural gas deposits are also being used so rapidly that even within our lifetimes their supplies will be substantially depleted.

Many of the fossil fuels that we have used have been those that were relatively easy to extract from their sources. Part of our current use of energy is that energy which must be supplied in order to extract and refine our remaining deposits. *Net energy* is the term used to describe the energy over and above that which is used to obtain the new supply. In many instances so much energy must be expended that the net energy gain is almost negligible.

It is obvious that two things are necessary for our future in the world. First, we must recognize that these problems are global. Second, we must concede

Discussion (cont.)

that a major reorientation of values and priorities is inevitable. Even though other environmental problems are major, the energy problem attracts more attention from the public and seems to be set aside from all the others. Perhaps this is due to all the discrepancies carried in the media concerning our available supplies of energy. It may be due to the rapid increases in the costs of gasoline and home heating fuels. Some of the concerns may be caused by our government's non-establishment of a clear-cut national energy policy. A crucial environmental public policy issue such as this clearly calls for political and social, as well as scientific, understandings as a basis for solving the problems. An informed citizenry is essential if our country is to deal successfully with the changing energy situation we face.

Environmental implications of the nation's rapidly escalating energy consumption are numerous. Processing of oil shales and strip mining for coal could devastate millions of acres of land by the beginning of the new century. Tons of air pollutants are generated by the combustion of fossil fuels. Electric power plants have produced thermal pollution in rivers and shorelines, and millions of tons of radioactive wastes have already been produced by extraction, processing, and use. Waste disposal problems are mounting.

What are our alternatives? Conservation of energy and another change in our national life style may be steps in the right direction. But unless our demands for energy growth begin to slow down, these are only temporary solutions. What are the promises of solar, wind, geothermal, and tidal energy? These would not add much pollution to the environment and could be used as substitutes for fossil and nuclear fuels. What about converting garbage and other organic wastes to fuel by the process known as *pyrolysis*?

In 1979 as major oil companies continued to announce large increases in profits, wood burning stoves again appeared in many homes. Individuals dependent upon fuel oil for home heating purposes began to install solar power units in their houses. Nineteenth-century New England homes are being equipped with solar greenhouses. Read the two newspaper articles in the study guide Appendix. What are your reactions to these articles?

Discussion (cont.)

The environmental problem of finding a suitable energy source is essentially the same as all other environmental problems. What damage will be done to the ecosystem? What benefits will be received? What is the probability of unknown adverse effects?

Self-Test

The inventory on the following pages is for your benefit and is *not* to be sent to your instructor.

Written Assignment

This assignment is to be submitted to your instructor.

Select at random ten or twelve members of your class or neighborhood. Ask them to respond to the items in the inventory. After you have completed this task, assemble your data in some organized fashion and attempt to analyze the responses. Report your conclusions.

How do the group responses compare with your personal inventory?

Are the members of your group energy-conscious?

What kind of recommendations or suggestions would you offer for making your group members more aware of the energy situation?

Energy Inventory

The following items measure how you feel about the energy problem. Circle either T or F for each statement. Please be as honest as possible.

T F 1. I would be willing to ride a bicycle or take a bus to school in order to reduce air pollution.

T F 2. It makes me angry to think that the government does not do more to help control strip mining.

T F 3. I keep track of my representative's and senator's voting records on energy issues.

T F 4. I would be willing to use a rapid-transit system or public transportation to help relieve the oil crisis.

T F 5. I am not willing to do much about the conservation of energy because it is really the government's job.

T F 6. When I think of the ways industries add to pollution, I become angry.

T F 7. I make an effort to buy products in recyclable containers.

T F 8. I would be willing to write to my congressperson weekly concerning energy problems.

T F 9. I am not willing to give up driving on a weekend to conserve fuel.

T F 10. Even though it may be inconvenient, I would be willing to cease buying products from industries guilty of polluting the environment.

T F 11. I have contacted a community agency to find out how I can conserve energy.

T F 12. I have made an inventory of my home to determine how energy can be saved.

T F 13. I probably would not be willing to go from house to house to distribute literature about energy.

T F 14. The whole energy problem is overrated.

T F 15. I have never attended a public meeting about energy.

(continued)

Energy Inventory (cont.)

T F 16. I have made a special effort to learn about nuclear energy.

T F 17. I read newspaper and magazine articles about alternatives to fossil fuels.

T F 18. I am not really interested in alternative forms of energy.

T F 19. I would be willing to pay increased taxes for the development of future supplies of energy.

T F 20. The general lack of concern people have for the way industry uses energy is all right as long as industry maintains the supply of products people need.

Urban Environment

Objectives

After completing Lesson 8 you will be able to

1. gain perspective on the modern city and its environment
2. describe the metabolism of a city in terms of intake of air, water, and foodstuffs, the extraction of energy, and its production of wastes
3. recognize the need for careful planning in the growth of towns and cities
4. relate the growth problems of metropolitan areas to the growth of populations

Reading Assignment

What's Ecology?, pages 197-218.

Lew Sichelman, "Breaking the $150,000 Barrier," study guide Appendix, pages 46-47.

Discussion

At a time when a significant proportion of the city's children are at war with their environment, the question raised by a current newspaper article is, "How will we live in 2000?" According to the author, surgery will have advanced far enough so that changing parts of one's body will be as normal an occurrence as installing new motors in old cars. Robots will direct traffic, plow fields, fight fires, and do other chores

Discussion (cont.)

that humans would rather not. City life will be organized on a vertical basis. A person leaving home might go up to the theater or down to the factory.[1]

It is often stated that an enormous range of possible experiences and activities is open to the city child, but usually these are activities that benefit the upper and middle-class children. Football and other sports, popular musicians appearing at recording studios or concert halls: all are forms of entertainment enjoyed by such children. The minority children within the city desire to engage in these activities too. How can this best be made possible?

Traffic has always been a hazard for the urban child. Old pictures of Victorian city streets show persons wandering all over the road ignoring horsedrawn vehicles all around them. The granite streets were manured continually with horse-dung; it was either shoveled up or ground into the road surface by the next set of hooves and iron-tired wheels. The gutters in which children played were lined with chaff and pieces of hay tossed out of horses' nosebags. How do these conditions compare with those of today's city streets? Do the children in your city play in the streets, or are there well-planned parks and recreation areas for children and adults?

In the United States and other highly industrialized countries, more people are living more comfortably, more securely, and for longer periods of time. Technology has helped to make spectacular gains in the ways of producing both the needs and luxuries of life. However, are these advances being made at the cost of increasing deterioration of our environment (particularly the environment of the cities), pollution of its air, overcrowding, and loss of living space? Many persons now worry that in the process of satisfying our material needs severe environmental problems are being created that make it more difficult for humans to live

[1]from: Serge Berg. "How Will We Live in 2000? Oddly! Says This Author." The *Indianapolis Star*, January 20, 1980, section 1, page 23.

Discussion (cont.)

with each other. These problems include crime, poverty, and stress. Are these increasing or decreasing in your city? What factors in your environment, other than the physical, seem important to a "good quality" of life?

The term *quality of life* means different things to different persons. Many of us will measure our life quality with the degree to which we are reaching our personal goals. Some of us may consider a nice home, a happy marriage, an automobile, a good job, and the like as important. In some parts of the world, and even in our own city, other persons might consider a good wholesome meal, freedom from oppression, and a comfortable place to sleep as adding up to good quality of life. One person's concept of a good quality of life for himself or herself may differ very extensively from what he or she may consider a good quality of life for others.

Is there a shopping center in your neighborhood? How many acres of concrete and asphalt have been poured in the area over the last ten years? Were adequate plans made for landscaping, improvements, or sufficient drainage outlets? What has happened to the traffic flow in the neighborhood? What effects has it had on the people living in the adjacent area? Has the noise pollution level increased? Is the area properly (and aesthetically) landscaped? Whenever changes are made or planned that affect the environment and/or the humans within it, someone has to anticipate the consequences of these changes. Some of the richest farm land in the world has been covered by concrete in order to build shopping centers, airports, and miles of highways. Many homes and buildings in cities have been removed to make room for the construction of interstate highways. Are there any stringent zoning and land-use laws in your city? How do you check urban sprawl and loss of open space?

Self-Test

What's Ecology?: On pages 217-218, concentrate on Test Yourself items 1, 2, 3, 4, 8, and 11.

Try to answer these from memory. If you have difficulty, look up the answers in your textbook. This test is for your benefit and is *not* to be sent to your instructor.

Lesson 8
Multidisciplinary Education 31E

Written Assignment

This assignment is to be submitted to your instructor.

Submit one of the following.

1. Model City

   Purpose: to identify alternative ways in which human needs might be served in an urban setting.

   Materials: a large sheet of brown paper approximately one square yard in size which represents a land area of one square mile, colored crayons, drawing pencils, or felt-tip pens.

   Procedure: Design a self-contained model city to house approximately 50,000 people in which all the basic services (police, recreation, health care, shopping, waste disposal, water, power, and the like) are provided.

   Requirements and constraints:

   1. The city must recycle all its wastes.
   2. The city must supply all its own power.
   3. The city must be pollution-free.
   4. The city must take up no more than one square mile of land area.
   5. All parts of the city must be easily accessible by mass transit.

2. Tree Investigation

   Purpose: to develop a plan for improving the landscape or for adopting a tree ordinance in your city

   Materials: note pad and/or camera, tree identification books, resource persons

   Procedure: Take a field trip in some area of your community and survey the existing trees to determine the need for a street tree-planting program. Make a map of the area and record the necessary data such as the width of the streets, location of utilities, width of planting strips, healthy trees

Written Assignment (cont.)

that should be preserved, diseased trees that need attention, areas where new trees are needed, and the like.

Consider the following resources:

Audubon Society
City engineer
City Parks and Recreation Department
Cooperative Extension Service
County Extension Agent
Department of Natural Resources
Soil conservationist
United States Department of Agriculture

Make sketches or take pictures which illustrate the effective use of trees in the community. Consider both the ecological and environmental factors influencing the selection of appropriate trees.

Identify any existing city ordinances governing community planting. If there are none, evaluate your data and try to determine how a tree ordinance might benefit the beautification of your community.

Identify the power structure of the city and determine the appropriate committee or persons responsible for drafting and approving ordinances. If there is a city Planning Commission, attend one of its meetings. With the help of various individuals whom you have identified, try to present your plan to the Commission.

Record your activities and submit them to your instructor.

DO YOU SHARE ANY VALUES WITH THESE PERSONS?

HAIRCUTS 1.75
FLAT TOPS

Developing an Environmental Ethic

Objectives

After completing Lesson 9 you will be able to

1. devise a working definition of "attitudes" when dealing with values and attitudes
2. list several examples of your own activities or attitudes which indicate whether or not you possess an environmental conscience
3. describe a potential climax community which includes yourself
4. write a successful dilemma statement which weighs human values
5. read and critique an article which involves environmental problems or a problematic situation; this will enable you to sort out the issues and in terms of your own values make decisions about the issues

Reading Assignment

What's Ecology?, pages 162-177 and 219-232.

Investigating Our Ecosystem, pages 148-158.

Dick Kirschten, "Earth Day '80--Where Are We," study guide Appendix, pages 48-51.

Patrick T. Morrison, "Agent Orange," study guide Appendix, pages 52-53.

Reading Assignment (cont.)

Philip Shabecoff, "New Rules Issued to Protect Workers from Carcinogens," study guide Appendix, pages 54-55.

Richard Hamilton, "Maine Voters Pulverize Bottle Bill Opposition," study guide Appendix, pages 56-57.

Discussion

In his World Environment Day message (June 5, 1974) United Nations Environment Programme Director Maurice Strong said:

> The transition to society in which the resources of planet earth are used to give its inhabitants access to a life of dignity and plenty without destroying the environment on which this life depends will require a concerted search for new life styles, new patterns of consumption and production and new dimensions of cooperation.[1]

The way of life shared by the members of any group or community, local, national, or international, lies in its fundamental values. Shared commitment to living according to certain basic values enables the members to function as a society. All individual values may not be shared values. But certain values, those necessary for basic functioning of society, must be recognized and accepted by most persons as the "good" or "right" rule of behavior by which its members are to live.

An environmental ethic involves concern with environmental values. Such values refer to relations of humans to each other and to other organisms on the earth. Decisions are based on values, and values change. We need to understand reasons for making decisions, and we need practice in making decisions.

Within the few centuries that humans have inhabited the earth, many of the planet's rich natural resources have been seriously depleted. We are searching for

[1]Maurice Strong. "World Environment Day Message." *New York Times*, June 6, 1974, page 6.

Discussion (cont.)

alternate sources of energy. Millions of acres of fertile soil have washed away. Several animals and plants are threatened with extinction. We are using up our natural resources so rapidly that they will be gone within a short period. Throughout modern history, humans in the Western world assumed that they could do almost anything if they could simply figure how to control the natural world. The explosion of technology has been astonishing. At no other time in history have persons made such extreme changes in our environment.

When we consider all of the effects of an environmental change, we seldom find a simple choice of right or wrong, good or bad. Each possible course of action will probably produce some benefits and some disadvantages. We must be able to anticipate or estimate the consequences. Information needs to be gathered; logical decisions have to be made. We must learn to deal with these complex value judgments.

One of the ways to gain practice in dealing with issues is to prepare a *dilemma statement*. A dilemma is built around a story that has a central character, circumstances, and issues. To be a workable dilemma, the story must have:

1. a central character (an individual or a group acting as an individual)
2. facing a problematic situation
3. who must make a choice
4. among a variety of alternatives
5. that involve a decision (about rightness or wrongness)

To be workable, the story also must

1. be open-ended (be without a single, correct, socially approved response)
2. be short
3. describe reasons for acting in a number of alternative ways
4. involve three or more issues
5. pose the question, "What should I do?"
6. provide background data

The following dilemma was written by a student. Does it contain all of the necessary elements?

Discussion
(cont.)

HOW WOULD YOU VOTE?

You are starting to build your own independent business and have found the task to be very strenuous. Recently you have been employed by a local environmental action group to investigate and determine the consequences of the expansion of a construction company to an untouched area of the county. This project could be the beginning of a prosperous career. It is the break for which you have been waiting.

Your studies indicate that the expansion of the company will have only minor environmental effects on the area. However, you personally feel that the area should be left untouched. There are very few such areas left in the county; these should be preserved for future generations of citizens. On the other hand, the president of the company is your former employer to whom you owe some loyalty. Hundreds of persons who work for the company, many of them close friends, may be out of work if your decision blocks the expansion of the plant.

What would you do in this situation? Would you recommend the expansion of the company, or would you suggest that this expansion be blocked to preserve this natural area?

The following two situations are also student-prepared dilemmas. Read them to members of your class or to your friends. Ask your parents to react to them. Do they all have the same solutions? Why do you think they react as they do to each of the dilemmas?

AN ECONOMIC FAMILY DECISION

Craig, a hard-working family man, is a factory worker for a major car manufacturer. His wife is unable to work because of a physical condition. They have one child in college and two more in high school. With gloomy car sales reports, Craig fears that he may be out of work.

Discussion (cont.)

Craig owns a sizable tract of timberland in another state. He and his father built Craig's first home on the land. He raised his children there until work conditions forced him to relocate. Upon his retirement, Craig and his wife had planned to return to their home in the woods.

A large coal company has offered Craig an unbelievably large sum of money for the property. Craig is tempted to accept the offer, since he never could earn that much money if he continued to work until normal retirement. He is concerned about his economic situation, since his children need a lot of money for school, clothes, and other expenses. However, Craig does not like the thought of his land becoming a strip mine, eroded, and bare of trees. Craig and his family have strong sentimental ties to the land.

What should Craig do? Should he guarantee economic stability for himself and his family by selling out to the coal company, or should he take a risk and hold on to the land he and his family love?

THE URBAN DECISION

George O'Neal, the most recently elected member of the city council, has been on the city planning committee for approximately six months. The committee has been conducting research into the advantages and disadvantages of building a modern office, shopping, and city services building in the center of town. This building, promised the architect, would vastly improve the services provided by the city. The design, an architectural wonder, would bring in many new and interesting business people. These new persons and businesses would boost the sagging city treasury and the city economy.

The building needs to be centrally located. However, previous city councils have remained loyal to the precedent adopted soon after the town was founded. This precedent decrees that the central six-block area square must remain as originally built and that only needed repairs should be made to keep it representative of the era when the town was founded.

Discussion (cont.)

The planning committee has had pressure from the business community to locate the building in this centrally located area, which had been set aside by the founding council. Their argument is: "If the town is to survive, we must have the building in that area. Let history be preserved somewhere else. History doesn't feed hungry persons."

The historic preservation group also has pressured the committee. The group urged that the building be built somewhere other than the center of town. They argue that, even if some of the already existing businesses must be removed, it would be better to lose a few businesses than to lose a concentrated and nostalgic preservation of the originally built town. They also contend that nowhere else is there a better preservation site.

George is a nostalgia buff, but he was elected to the council on a modernization platform. The committee votes tomorrow. If you were George, how would you vote and why?

Another way to measure your own environmental conscience is to read a report or a news article, attend a public hearing involving some construction or environmental action in your own community, or critique an article like "Earth Day '80--Where Are We," (to be found in the study guide Appendix). Have others critique the same article and discuss it with them. What are your conclusions about or assessments of the article? Can you discuss it with other students in one of your classes or youth groups? Environmental issues are not limited to our formal classrooms; they are present in all of our daily activities.

Today the newspapers, as well as other media, print numerous articles related to environmental affairs. Often these stories feature citizen actions and concerns about their communities. There appears to be a great increase in the awareness of the environment and our role in protecting and improving it. People are beginning to question the extensive, and often careless, use of some insecticides and pesticides and their

Discussion (cont.)

cumulative effects on human health. Recycling programs, the disposal of solid and toxic wastes, the use of dangerous substances in manufacturing, and the anxieties associated with nuclear power occupy the headlines. We, as citizens, need to be increasingly aware and informed of all of these activities, and we need to make a concerted effort to press our administrative officials into making wise decisions about their use.

Examples in the study guide Appendix, such as the article on "Agent Orange" and the one about "New rules issued to protect workers from carcinogens," are from large metropolitan daily newspapers. The *York County Coast Star*, a well-known regional New England weekly, describes the role citizens (including students influencing their parents!) play at the ballot box.

Woodrow Wilson shared this advice during his 1912 presidential campaign:

> ...What I fear is a government of experts. What are we if we are to be scientifically taken care of by a small number of gentlemen who are the only men who understand the job? Because if we do not understand the job, then we are not a free people...[2]

As the environment about us grows ever more complex, our apprehension regarding the changes creates confusion. Will we as average citizens tolerate loss of freedom as the price we might pay for permitting "experts" to make our own value judgments? In our kind of democracy, public policy still reflects the choices of individual voters. Citizens must make the final choices. Lay persons as well as educators, scientists, theologians, government leaders, and medical professionals must be drawn into public debate. To become actively involved in making wise decisions is a challenge of our times.

[2]John Wells Davidson, ed. *A Crossroads of Freedom. The 1912 Campaign Speeches of Woodrow Wilson*. New Haven, Conn.: Yale University Press, 1956, page 83.

Lesson 9
Multidisciplinary Education 31E

Self-Test

What's Ecology?: On pages 176-177, work on Test Yourself items 1, 2, 3, and 5. On pages 231-232, work on Test Yourself items 2, 3, and 4.

Try to answer these from memory. If you have difficulty, look up the answers in your textbook. This test is for your benefit and is *not* to be sent to your instructor.

Written Assignment

This assignment is to be submitted to your instructor.

1. *Investigating Our Ecosystem:* On pages 155-158, write out *either* Environmental Conscience Series 4 *or* 5. Include the Prelab, Lab, and Postlab.

2. *What's Ecology?:* On page 177, write out the answers to Test Yourself items 6, 7, 9, and 10. On pages 231-232, write out the answers to Test Yourself items 1, 6, and 7.

3. Clip or photocopy an environmentally related article from a newspaper or magazine that is available to you at home or at your school library. Rewrite the situation in the form of a dilemma statement. Send both the article and dilemma to your instructor. For extra credit, test your dilemma statement on some of your friends or members of your family. Send in the results along with the rest of your assignment.

FINAL EXAMINATION

Tips for the Final Examination

10

When you have completed the work for Lessons 1-9, you will be ready to take the final examination. Read the following pages for further information on applying for the examination.

The final examination will count as 20 percent of your final grade. The examination will contain essay questions. Clip or photocopy one or two environmentally related articles from a newspaper or one of your favorite magazines. Bring them with you to your examination. Some of your final examination questions will have references to your article(s).

You will not be allowed to use your study guide, study notes, textbooks, dictionaries, or any other supplementary materials while taking this examination. You will have two hours in which to complete the examination.

PROCEDURES FOR ARRANGING EXAMINATIONS

Submit the application for examination only after you have completed all prior lessons or, in exceptional cases where lessons have not been submitted, with the written approval of the instructor.

Most examinations require a period of two to three hours unless a longer time is specified in this study guide. Adequate personal identification will be required by your supervisor. Come prepared.

If credit is needed for a specific date, your examination must be taken at least two weeks before that date, which means that your request for the examination must be received nearly four weeks before the date on which your grade must be filed.

Most scheduling problems occur during the end-of-the-semester months when many students' graduations are at stake. Although arrangements for examination can generally be made, no special arrangements for grading of the examination can be made since instructors are also busy at that time. Consequently, despite our best efforts, students may fail to graduate until the following year.

THEREFORE, IF YOU HAVE A SPECIFIC DEADLINE TO MEET, BE SURE TO COMPLETE YOUR LESSONS AND TAKE YOUR EXAM BEFORE END-OF-SEMESTER MONTHS. EXAMINATIONS CAN BE TAKEN DURING ANY WEEK OF THE YEAR.

PLACE: Students must take their examinations under the supervision of an administrative officer or faculty member of an accredited college or university, or at an accredited high school. A student currently attending high school must take the examination at that school. Military personnel should arrange for their education officer to supervise their examinations. If within a convenient distance, examinations can be taken at one of the centers listed on the next page.

TIME: The Independent Study Division must receive your application for the examination at least 10 days prior to the date on which you intend to take the examination. Arrangements must be made with a supervisor through the administrative offices of the centers listed below or of the college, university, or high school.

COST: There is no charge for supervision of examinations by any office of Indiana University. Supervision charges by other institutions are the student's responsibility.

Should you have questions about examination arrangements write to or call the Independent Study Division.

Toll-free number in Indiana: 1-800-822-4792
Toll-free number outside Indiana: 1-800-457-4434

EXAMINATION CENTERS IN INDIANA

Indiana University Bloomington	Independent Study Division Owen Hall 002 Bloomington 47405	812+337-1851 (See reverse for toll-free numbers.)
Indiana University East	Division of Continuing Studies 2325 North Chester Boulevard Richmond 47375	317+966-8261
Indiana University - Purdue University at Fort Wayne	Student Services 2101 Coliseum Boulevard East Fort Wayne 46805	219+482-5616
Indiana University - Purdue University at Indianapolis	Evening Administration Office Krannert Building, Room 153 1125 East 38th Street Indianapolis 46205	317+923-1321 extension 238
or	Evening Administration Office Nursing School 105 1100 West Michigan Avenue Indianapolis 46202	317+264-4228
Indiana University at Kokomo	Student Affairs 2300 South Washington Street Kokomo 46901	317+453-2000 extension 215
Indiana University Northwest	Division of Continuing Studies Administrative Annex, Room 126 3400 Broadway Gary 46408	219+980-6829
Indiana University at South Bend	Division of Continuing Studies 1700 Mishawaka Avenue South Bend 46615	219+237-4261
Indiana University Southeast	Student Development Center 4201 Grantline Road New Albany 47150	812+945-2731 extension 312
Columbus Center at IUPUI	Office of the Director 2080 Bakalar Drive Columbus 47201	812+372-8266

780

APPLICATION FOR FINAL EXAMINATION
(to be filed after all assignments are submitted)

Registration number_____ Equipment None

Multidisciplinary Education 31E: Environmental Studies

Lesson 10

Date set for examination_____
(make a definite appointment with supervisor)

Name of supervisor_____

Supervisor's official title_____

_____
(name of institution)

Supervisor's office address_____
(street number)

_____
(city, state, and zip code)

_____
(county)

Comments:

_____
(signature of student)

_____
(street or rural route)

_____
(city)

_____ _____
(telephone number where you can be reached) *(state and zip code)*

(This form is to be mailed to the Independent Study Division in the envelope marked "Examination Request.")

CONGRATULATIONS!

You have completed this independent study course, demonstrating that you are a disciplined and motivated student. Whether you enrolled in this course for personal enjoyment or to earn credit toward a diploma or degree, there are other independent study courses which may interest you. Some related courses are:

Science 11E: Earth Science, First Semester (½ unit)
Science 21H: Horticulture, First Semester (½ unit)
English 01M: Mass Media (½ unit)

You may use the enrollment application in this study guide to enroll in another course.

If the above courses do not interest you at this time, we offer more than 250 other correspondence courses. For a copy of our bulletin which includes a full list of courses, complete the bottom portion of this form and mail it to us.

There is also space on this form to indicate areas of study or particular courses which we may not offer but which would be of interest to you. We welcome your suggestions.

Please send a bulletin. I am specifically interested in

___ high school ___ university ___ continuing education

Other areas of interest_____

_____

Name_____

Address_____

City, state, zip code_____

Why not have a bulletin sent to a friend?

Friend's name_____

Address_____

City, state, zip code_____

Independent Study Division
Indiana University
Owen Hall 001
Bloomington, Indiana 47405

SELL BACK YOUR BOOKS

You may sell back your textbooks for this course for one half the list price, provided they are still used by the Independent Study Division. Complete this form and enclose it with the books. Be sure to package them securely.

Name_____

Current address_____

_____

Course Multidisciplinary Education 31E: Environmental Studies

Registration number_____

INDIANA UNIVERSITY
INDEPENDENT STUDY DIVISION
ENROLLMENT APPLICATION

7-26
Applicant's full name (last name, 2 spaces, first and middle)

Social Security number

27-46
Address

47-68
City and state

69-73
Zip Code

( )
Telephone number

Date of birth

Are you currently enrolled in a degree program? ..... Yes ..... No

School

I.U. campus

Major

Class

Check one: I am enrolling for

..... External degree credit
..... I.U. credit other than External Degree
..... High school credit
..... Other .....

Office use only
2-6 Registration #
75-80 Enrollment date

If credit is to apply toward a diploma or degree, written approval from a counselor, principal, or dean must be given below.

I approve this enrollment.

Signature

Title

( )
Telephone number

Approving person's name—please print

Institution

Division or department

In signing this application, I agree to abide by the policies governing independent study.

X
Student's signature

Today's date

COURSES DESIRED

Department	Course number	Course title	Cr. hrs. or units	Check if credit not desired

FOR OFFICE USE ONLY

7-10 Department
11-14 Course
15 Enrollment code
16 Credit
17 External degree campus

18-23 Instructor number
24-25 Max. L.
29-39 Instructor SS
Instructor campus

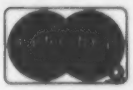
66-80 Instructor's name

Envs.
Exams
Equipment

Please complete information on reverse side.

Check the method of payment:

___ **Using Master Charge. Provide the necessary information below.**

CREDIT CARD NUMBER			Name on card—please print
	Card I.D. Number above name on card	Good Thru	Signature of card holder

___ **Enclosing a check or money order (payable to INDIANA UNIVERSITY) for course fees, and requesting that the study guide and textbooks be shipped C.O.D. Refer to the course listings for exact course fees. C.O.D. service is available in the United States (except Alaska and Hawaii). The address cannot be a post-office box number.**

___ **Enclosing a check or money order (payable to INDIANA UNIVERSITY) for course fees, study guide, textbooks, transportation, and handling. Since textbook prices continually increase, this last method can involve a delay if insufficient payment is enclosed. We therefore encourage students to use one of the other methods listed above.**

1.	Course fees (refer to course listings)		$ .....
2.	Required study guide ($4 per course)	.....	
3.	Textbooks (refer to course listings)	.....	
	..... I prefer used books if available.		
	..... I prefer new books		
4.	Subtotal for lines 2 and 3	.....	
5.	Indiana residents add 4% state sales tax to line 4	.....	
6.	Transportation and handling ($2 if ordering books)	.....	
7.	Supplies subtotal (lines 4, 5, 6)	.....	.....
8.	Airmail lesson return postage (for overseas addresses only): $10 per course		.....
9.	Total cost of enrollment (lines 1, 7, 8)		$ .....

POLICIES:

Rejection:
If the application is rejected, a full refund will automatically be made.

Withdrawals:
High school and continuing education **course fees will be refunded, less $10 and $1.90 per lesson submitted, if withdrawal occurs within two months of acceptance.** ***University*** **course fees will be refunded, less $10 and $2 per lesson submitted, if withdrawal occurs within one month of acceptance; if between one and two months of acceptance, one half the course fees will be refunded, less $2 per lesson submitted.**
The Independent Study Division must be formally notified of the intention to withdraw.

Textbook returns: **Unmarked textbooks may be returned for a full refund within 30 days of purchase, provided they are still used in the course. After 30 days, students may sell back their textbooks for one half the list price, provided the books are still used in the course.**

Airmail shipment of materials: **Foreign book rate is very inexpensive, but may take up to three months for delivery; air parcel post is quicker, but much more expensive. Students at overseas addresses will be notified of the cost of shipping materials by air parcel post, prior to shipment; if they wish, they can send the necessary amount for such shipment at that time.**

APPENDIX

APPENDIX, PAGES 43-57, REMOVED DUE TO COPYRIGHT RESTRICTIONS.

ASSIGNMENT COVER SHEET

Independent Study Division
Indiana University, Owen Hall
Bloomington, Indiana 47405
812-337-3693 or,
Toll free in Indiana:
Instructor: 1-800-822-4762
Administration: 1-800-822-4792

An assignment cover sheet should be attached to the front of each individual assignment.

Date Submitted .....

Name .....

Street .....

City, State ..... Zip .....

This paper will be returned in a window envelope. Please give your complete mailing address. Fold your completed assignment on the dotted line below so that the address will show in the window.

Course .....

Registration Number .....

Assignment Number .....

Instructor's Name .....

Grade .....
(Leave blank for Instructor)

Instructor's Comments:

Student's Comments and Questions

(To be completed by Student)

Name .....

Registration Number .....

Course .....

Assignment Number .....

Grade ..... Date Graded .....
(Leave blank for Instructor)

Check here if this is a name change for our records ☐

If you have a new mailing address, please indicate on the following blanks:

Street .....

City .....

State ..... Zip .....

Phone .....